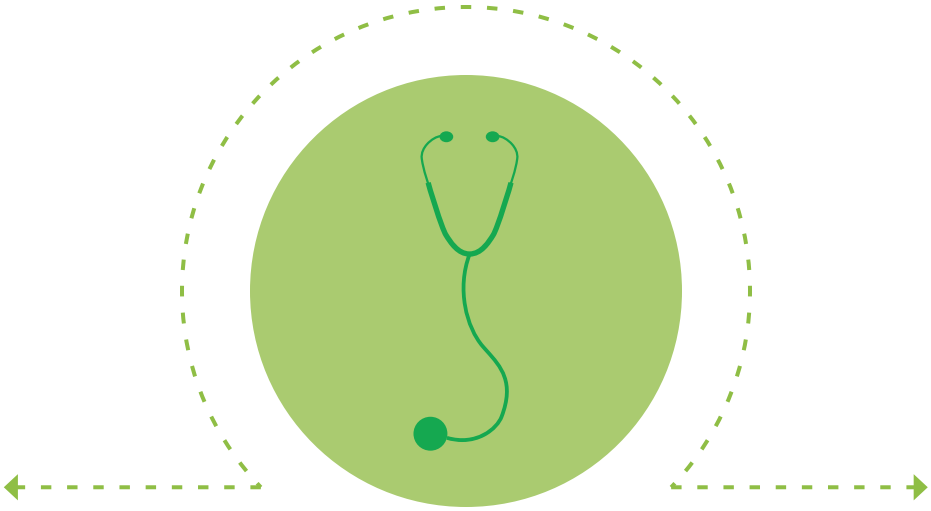


Care Process Model

Chronic Obstructive Pulmonary Disease

MISSION HEALTH

Care Process Model

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

MISSION HEALTH

WHAT IS MULTIDISCIPLINARY CARE?

Multidisciplinary care is agreed upon, interdisciplinary, patient-centered, disease-focused, care delivery systems that are informed by a series of evidence-based care process models. Multidisciplinary care supports the achievement of the BIG(GER) Aim systematically across the continuum of care.

WHAT IS A CARE PROCESS MODEL (CPM)?

Care process models ensure that all care delivered by a hospital and its caregivers is medically necessary, the leading edge in medical science and the appropriate treatment intensity. Put into effect, these models will systemize treatment processes across all hospitals and practices, improving consistency as well as effectiveness.

This CPM summarizes Mission Health's multidisciplinary care of COPD.

WHAT ARE THE BENEFITS OF A CPM?

- Reduces variation
- Utilizes the best practice from literature and expert opinion
- Improves care delivery process
- More readily exposes errors
- Variation study informs revisions to CPMs

TABLE OF CONTENTS

KEY FEATURES OF MULTIDISCIPLINARY CARE OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

- Evidence-based assessment: Considerable scientific evidence supports the use of a structured assessment process throughout the care continuum utilizing specific diagnostic criteria and tools.
- Multidisciplinary team approach: Expertise along with patient-centered interventions from various disciplines are frequently needed in the management of patients with chronic disease and the prevention of further complications. Collaboration occurs among physicians, nurses, respiratory therapists, physical therapists, pharmacists, case managers, social workers, dieticians and other disciplines to assist patients with COPD.
- Patient education: Patient education in the treatment process is critical for successful self-management. In the hospital setting, education occurs on a daily basis and includes preparation for post-hospital care and recovery.
- Comorbidities: Acute myocardial infarction, congestive heart failure, cerebrovascular disease, cardiac arrhythmias, diabetes, pulmonary circulation, ischemic heart disease, lung cancer and other cancers are comorbidities relevant to patients with COPD.(1) Therefore a multidisciplinary team will be utilized in order to provide safe, effective, evidence-based care for patients with COPD and multiple comorbidities.

WHY FOCUS ON COPD?

- **COPD is common and underdiagnosed.** In the United States, COPD affects 14.8 million Americans, and another estimated 12 million Americans are undiagnosed.(2) More than 3 million people died of COPD in 2012, which is equal to 6 percent of all deaths globally that year.(3) Worldwide, COPD is under-recognized and underdiagnosed. (2,4,5) It has been estimated that one-half to two-thirds of patients with COPD remain undiagnosed, leading to untreated symptoms, recurrent exacerbations, and increased emergency room visits and hospital admissions.(6)
- **COPD prevalence continues to increase.** COPD is the third leading cause of death in the United States. The prevalence and burden of COPD is expected to increase over the next several decades, driven by the growing and aging population worldwide, a continuing smoking epidemic, and increasing occupational and environmental exposures to lung irritants.(5) The disease now affects men and women almost equally, due in part to increased tobacco use among women in high-income countries.(3) Tobacco smoke (through tobacco use or second-hand smoke) continues to be the primary cause of COPD. COPD is the only major disease for which prevalence, hospitalizations, and mortality continue to increase.(5,6)
- **Evidence-based COPD care improves outcomes and reduces costs.** Even though COPD is under-recognized and underdiagnosed, it is one of the most costly conditions in the United States. The costs associated with COPD have been estimated to total almost $50 billion; COPD exacerbations account for 45 percent to 75 percent of these costs. Improved symptom management and reduction in exacerbations would reduce the cost burden of COPD and improve patient quality of life. However, evidence-based best practices for COPD care have not been adopted in clinical practice, resulting in a significant clinical and cost burden.(6,7)

Care Process Model

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

MISSION HEALTH

GOALS

The care process aims to do the following:

- Provide evidence-based standards and/or best practice recommendations for diagnosis and management
- Provide quality metrics to assess, evaluate and improve our care of COPD patients
- Utilize multidisciplinary rounding to address safe and effective transitions of care for persons with COPD from inpatient to ambulatory care settings
- Increase use of spirometry for diagnosis and determination of severity of disease using GOLD Classification
- Encourage appropriate use of Palliative Care consultation for advanced life-limiting COPD
- Increase use of counseling and resources for smoking cessation
- Improve coordination of care and communication between primary care providers, specialists, and hospitals in the care of shared patients with COPD

This care process model (CPM) was developed by multidisciplinary clinical experts from Mission Health, based on guidelines from the Global Initiative for Chronic Obstructive Lung Disease (GOLD), the American College of Physicians, the American Thoracic Society (ATS), and others. The CPM recommends screening, diagnosis, and treatment processes to improve care and outcomes for patients with COPD.

COPD DEFINITION

The new GOLD criteria deemphasizes the use of emphysema and chronic bronchitis as definitions of COPD.

COPD is a common preventable and treatable disease characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lungs to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients.

Emphysema is a pathological term describing the destruction of the gas-exchanging surfaces of the lung (alveoli).(4)

Chronic bronchitis is a clinical term for the presence of cough and sputum production for at least 3 months in each of two consecutive years.(4)

DIAGNOSING COPD

Risk Factors for the Development of COPD

- The primary cause of COPD is tobacco smoke(4)
- Second-hand smoke exposure
- History of inhalation exposures
- Familial or genetic tendency for COPD (i.e., Alpha-l antitrypsin deficiency)(8)

Symptoms Include

- Progressive dyspnea that increases with exertion or respiratory infections
- Chronic, persistent cough (intermittent or daily)
- Chronic sputum production
- Wheezing and chest tightness

DIAGNOSTIC TESTING

Spirometry
Spirometry is required to confirm the clinical diagnosis of COPD. Spirometry assesses for post-bronchodilator airflow obstruction. Obstruction is demonstrated with a forced expiratory volume in one second/forced vital capacity [FEVI/FVC] of less than 70 percent (as adjusted by predictive models of age, sex, and height) and confirms the disease.

Considerations

- Can be performed in clinic, hospital and even portable settings
- Can be performed alone or in conjunction with a complete set of pulmonary function tests
- Should be performed on patients over age 40 with COPD risk factors and symptoms
- Consider yearly spirometry
- Typically performed in outpatient setting to confirm diagnosis at time of steady state (i.e., not during exacerbation)
- Assists in prognostication and severity of disease (Figure I)

Elements of Spirometry

- FVC (forced vital capacity): The total amount of air a patient can forcibly blow out after a full inspiration (assesses lung capacity).
- FEVI (forced expiratory volume in I second): The amount of air a patient can forcibly blow out in the Ist second (defines COPD severity).
- FEVI/FVC ratio: The ratio of FEVI to FVC. Lower limit of normal varies by age. Reduced ratio required for the diagnosis of COPD.

Figure I. Sample Flow Volume Loops Demonstrating Severity of Obstruction

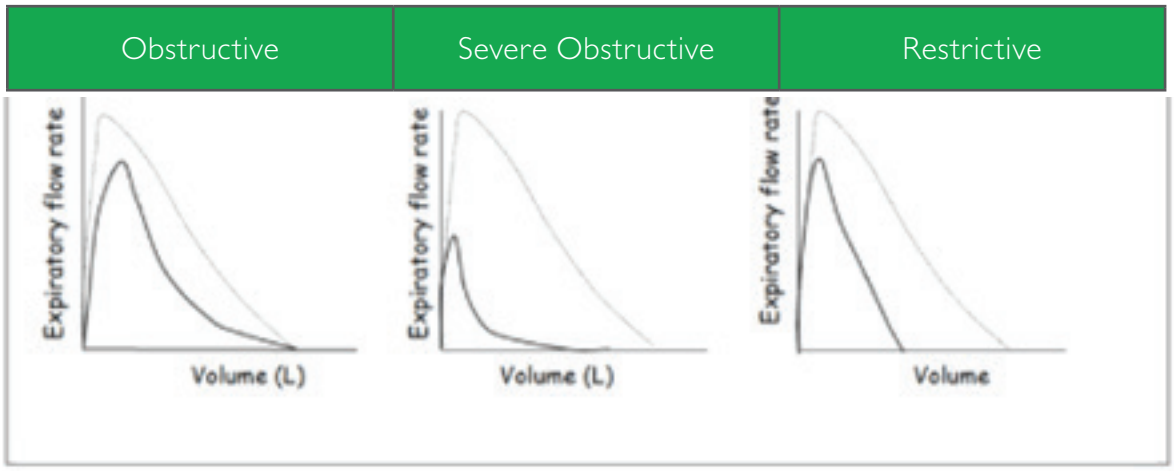


Table I.I GOLD Classification of COPD Severity

Classification of Severity of Airflow Limitation in COPD (Based on Post-Bronchodilator FEVI)		
GOLD I	Mild	FEVI ≥ 80% predicted
GOLD 2:	Moderate	50% ≤ FEVI < 80% predicted
GOLD 3:	Severe	30% ≤ FEVI < 50% predicted
GOLD 4:	Very Severe	FEVI < 30% predicted

Other Tests to Consider

- **Alpha-I antitrypsin** – Testing should be done in all adults with symptomatic fixed airflow obstruction, regardless if clinically labeled as COPD or asthma. Family testing of first-degree relatives is currently the most efficient detection technique.(8) (http://journal.copdfoundation.org/jcopdf/id/III5/The-Diagnosis-and-Management-of-Alpha-I-Antitrypsin-Deficiency-in-the-Adult)
- **Arterial blood gases (ABGs)** – Consider in active smokers, at initiation of oxygen or FEVI < 50% (Stage 3 or 4 COPD). Allows assessment of the degree of hypoxia as well as carbon dioxide retention.
- **Brain natriuretic peptide (BNP)** – Suspected heart failure or cor pulmonale. Note: May be normal in obesity despite volume overload; may be elevated in PE, right heart failure, or pulmonary hypertension.
- **Chest X-ray (CXR)** – Symptoms out of proportion to risk factor exposure.
- **Duel-Energy X-ray Absorptiometry (DEXA)** – Moderate to severe COPD; screening for osteoporosis; when considering steroid use.
- **Echocardiogram** – Suspected pulmonary artery hypertension or congestive heart failure; dyspnea without apparent cause; undiagnosed edema; elevated BNP.
- **Low-dose CT** – Current or former smokers 55 to 74 years old with at least 30 pack years smoking history, having stopped smoking less than I5 years ago and no history of lung cancer.
- **Nocturnal oximetry** – Moderate to severe COPD with no obstructive sleep apnea (OSA).
- **Resting and ambulatory oxygen assessment**

MODELS OF PROGNOSTICATION

Models have been developed to assist in prognostication. These often include a combination of objective (FEVI, 6-minute walk testing), and subjective (CAT score – COPD Assessment Test) assessment of the patient. Common models include the GOLD Grade classification and the BODE Index.(9) Other independent variables are also commonly used to gauge prognosis (Table I.2).

Furthermore, it is important to understand the variability of phenotype in the patient with the diagnosis of COPD. The GOLD Grade system seeks to express this variability by symptoms and number of exacerbations.(4)

Table I.2 Prognostic Factors Associated with COPD

Prognosticator	Description	Notes
FEV1	Forced expiratory volume in one second (post bronchodilator)	Most common prognostic indicator, yet wide individual variability
Body Mass Index		Weight loss is associated with worsening prognosis and increasing mortality
Hypercapnia	PaCo2 > 45	Chronic hypercapnia carries a higher risk of mortality over reversible or nonhypercapnic patients
Hypoxia	Pa02 < 55	Contributes to pulmonary hypertension, muscle fatigue, neurocognitive dysfunction, and inflammation
COPD Phenotype	Variability in disease such as emphysema vs. bronchitis	GOLD Grade A, B, C, D
Comorbidities	Acute MI, CHF, CVD, renal failure, diabetes, cardiac arrhythmias, depression, lung cancer, and other cancers	Additional comorbidities may impact survival
BODE Index	Includes 4 factors: BMI, FEV1, dyspnea score, exercise capacity	Can predict risk of death and hospitalization
Acute Exacerbations	Increased number likely denote worsening prognosis	90-day mortality at 33% post hospitalization. Variable outcome with many impacting factors.
GOLD Grade System	Further extends FEV1 as a prognosticator with addition of dyspnea score and exacerbations	

MANAGEMENT OF STABLE COPD

Overall management of COPD includes 5 elements: risk reduction, oxygen assessment, symptom control, immunizations, and self-management. Smoking cessation is the most important form of risk reduction regardless of severity of disease.

Risk Reduction

Identify and reduce exposure to risk factors:

- Smoking
- Occupational exposures
- Indoor and outdoor air pollution

Nicotine Cessation

- Assess readiness to quit with each clinical visit
- Consult nicotine cessation for appropriate and willing patients
- Consider pharmacotherapy

Treating Tobacco Use and Dependence: Clinical Practice Guidelines, Major Findings, and Recommendations(17)

- Tobacco dependence is a chronic condition that warrants repeated treatment until long-term or permanent abstinence is achieved.
- Effective treatments for tobacco dependence exist, and all tobacco users should be offered these treatments.
- Clinicians and healthcare delivery systems must institutionalize the consistent identification, documentation, and treatment of every tobacco user at every visit.
- Brief smoking cessation counseling is effective, and every tobacco user should be offered such advice at every contact with healthcare providers.
- There is a strong dose-response relation between the intensity of tobacco dependence counseling and its effectiveness.
- Three types of counseling have been found to be especially effective: practical counseling, social support as part of treatment, and social support arranged outside of treatment.
- First-line pharmacotherapies for tobacco dependence include varenicline, bupropion SR, nicotine gum, nicotine inhaler, nicotine nasal spray, and transdermal nicotine patch. At least one of these effective medications should be prescribed in the absence of contraindications.
- Tobacco dependence treatments are cost effective relative to other medical and disease prevention interventions.

Oxygen Assessment and Therapy

The long-term administration of oxygen (15 hours per day) to patients with chronic respiratory failure has been shown to increase survival in patients with severe resting hypoxemia (Evidence A). A decision about the use of long-term oxygen should be based on the resting PaO2 or saturation values repeated twice over three weeks in the stable patient.

- PaO2 at or below 55 mmHg (7.3 kPa) or SaO2 at or below 88 percent, with or without hypercapnia confirmed twice over a three-week period (Evidence B); or
- PaO2 less than or equal to 59 mmHg (7.85 kPa) or SaO2 less than or equal to 89 percent, if there is evidence of pulmonary hypertension, peripheral edema suggesting congestive cardiac failure, or polycythemia (hematocrit > 55 percent)
- Current data does not support the use of ambulatory oxygen in patient populations that do not meet the above criteria.
- Recent evidence does not support the use of oxygen in a patient with COPD and only moderate hypoxemia at rest or with exertion. Oxygen in this group did not reduce mortality, hospitalization, or rate of exacerbations.(10)

Treatment Goals

- Reduce Symptoms – relieve symptoms, improve exercise tolerance, improve overall quality of life
- Reduce Risk – prevent disease progression, prevent and treat exacerbations, reduce mortality

Pharmacologic Therapy

Pharmacologic therapy in COPD is used to reduce symptoms, frequency and severity of exacerbations, and improve health status and exercise tolerance. Existing medications for COPD have not been conclusively shown to modify the long-term decline in lung function that is the hallmark of this disease.

Bronchodilators (See Table 1.3)

Short-acting beta2-agonist (SABAs) are ordered as needed for monotherapy for mild COPD (Stage I) but can be used in combination for all stages.

Long-acting beta2-agonist (LABAs) are used for moderate to very severe COPD (Stages 2, 3, and 4). The choice between different long-acting bronchodilators (long-acting beta2-agonists [LABAs], anticholinergic, or combination therapy) depends on availability and individual response (symptom relief and side effects).

Anti-inflammatory therapy

Anti-inflammatory therapy most commonly is employed in the patient with more frequent exacerbation or with potential asthma overlap symptoms.

Inhaled corticosteroids (combination therapy)

Inhaled corticosteroids are often combined with long-acting beta agonists and typically are not used alone (as opposed to asthma therapy). Regular treatment with inhaled LABA and inhaled corticosteroids is appropriate for symptomatic patients with severe and very severe COPD (Stages 3 and 4), FEVI < 50 percent of predicted, and repeated exacerbations.(II)

Inhaled corticosteroid treatment has been shown to reduce exacerbations and improve health in these patients; it does not modify the long-term decline of FEVI. Combination therapy is associated with an increase of nonfatal pneumonia.

Oral glucocorticoids

Long-term treatment with oral corticosteroids is not recommended for COPD. It has not been shown to improve survival and has significant undesirable side effects. However, oral corticosteroids are useful in management of exacerbations.(4)

Other therapies

Roflumilast, a phosphodiesterase 4 inhibitor, has been shown to reduce exacerbation rates in COPD patients with more advanced disease.(I2) Similarly, macrolide antibiotics (azithromycin) have been used with some success at reducing exacerbation rates.(I3) Both are often employed following attempts at symptom control with inhaler therapy.

Mucolytic therapy with carbocysteine or N-acetylcysteine has shown variable effectiveness at reducing exacerbations.

Immunizations

Appropriate immunizations for a patient with COPD include yearly influenza vaccination. In addition, pneumonia vaccination should be offered as appropriate to include Pneumovax and Prevnar I3 vaccinations (see CDC recommendations https://www.cdc.gov/vaccines/schedules/hcp/adult.html).

SELF-MANAGEMENT

Pulmonary Rehabilitation

Guidelines strongly recommend pulmonary rehab (Evidence IA) to improve quality of life, reduce symptoms, and increase physical and emotional engagement in everyday activities, therefore reducing hospitalizations. Pulmonary rehab has been shown to improve peak oxygen consumption, endurance time, and workload. Optimum benefit is achieved with a 6-8-week program, and involvement within 4 weeks of discharge may prevent early readmissions.(4,I4)

Benefits of pulmonary rehabilitation in COPD

- Improves exercise capacity
- Reduces the perceived intensity of breathlessness
- Improves health-related quality of life
- Reduces the number of hospitalizations and days in the hospital
- Reduces anxiety and depression associated with COPD
- Improves arm function through strength and endurance training of the upper limbs
- Benefits extend well beyond the immediate period of training
- Improves survival
- Provides respiratory muscle training, which can be especially beneficial when combined with general exercise training
- Improves recovery after hospitalization for an exacerbation
- Enhances the effect of long-acting bronchodilators

Table I.3

Stage, Symptoms, and Exacerbation Risk	Recommended First Choice	Alternative Choice
Stage 1-2 Low risk for exacerbation < 1 per yr Few symptoms* (GOLD Grade A)	SAMA prn OR SABA prn	LAMA or LABA OR SABA + SAMA
Stage 1-2 Low risk for exacerbation < 1 per yr More symptoms* (GOLD Grade B)	LAMA or LABA	LAMA + LABA
Stage 3-4 High risk for exacerbation > 2 Less symptoms* (GOLD Grade C)	ICS +LABA or LAMA	LAMA + LABA or LAMA + PD4 inhibitor or LABA +PD4 inhibitor
Stage 3-4 High risk for exacerbation > 2 More symptoms* (GOLD Grade D)	ICS + LABA and/or LAMA	ICS +LABA +LAMA or ICS +LABA +PD4 inhibitor or LAMA +LABA or LAMA +PD4 inhibitor

*Symptoms are based on the CAT (COPD Assessment Tool) or mMRC (modified Medical Research Council)

COPD EXACERBATION

Definition of Exacerbation

An exacerbation of COPD is an acute event characterized by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations, and leads to increase use of medication for dyspnea and increased sputum volume and/or purulence. About one-third of exacerbations have no identifiable cause, but most are associated with environmental changes or infection. Infections may be viral or bacterial. The most common bacterial infections are H. influenzae, S. pneumoniae, and M. catarrhalis.(4,I4-I6)

Exacerbations are significant events that can potentially alter the course of the disease. Acute exacerbations can take several weeks to fully resolve. Furthermore, acute exacerbations increase the rate of decline of pulmonary function, are associated with an increase in hospitalizations and subsequent mortality, and have a high socioeconomic burden. (I,4,I8)

- The best predictor of having frequent exacerbations (2 or more exacerbations per year) is a history of previously treated events(4)
- Patients with a high risk of exacerbations tend to be in GOLD categories 3 and 4 (severe or very severe airflow limitation) and can be identified quite reliably from their own past history
- Worsening airflow limitation is associated with an increasing prevalence of exacerbations and risk of death
- Hospitalization for a COPD exacerbation is associated with a poor prognosis with increased risk of death(4)

Severity of Exacerbation

The severity of an exacerbation can be assessed by both subjective and objective clinical elements of the presentation (Table I.4).

Table I.4 Common Signs and Symptoms of a COPD Exacerbation

Signs	Symptoms	Other
Work of breathing	Degree of shortness of breath	Hypoxia and hypercarbia
Tripod body position	Wheezing	Hemodynamic instability
Accessory muscle use	Cough and sputum	Arrhythmia
Abdominal muscle paradox	Confusion	
Cyanosis		

Evaluation of a Patient with an Exacerbation

Evaluation of the patient with a COPD exacerbation may occur in many clinical settings including physicians' offices or emergency rooms. Baseline testing should include history and physical assessment. Supportive testing should be guided by clinical assessment and often includes CXR, ABG, and baseline labs. Careful assessment for alternative diagnosis or comorbidity should occur. Decisions to hospitalize should be based on failure to respond to initial therapies, persistence of symptoms, severity of presentation, and indicators of poor outcome (Table I.5).

Common Testing

- Pulse oximetry – assessment of oxygen requirements
- ABG – assessment of degree of hypoxia and hypercapnia
- Chest X-ray – evaluation of pneumonia, pneumothorax, effusions or CHF
- EKG, BNP, troponin, D-dimer – assess comorbid conditions of arrhythmia, myocardial ischemia, or pulmonary embolism
- Viral respiratory panel
- Sputum culture – often not helpful unless refractory to initial therapy or concomitant pneumonia

Table I.5 Predictors of Poor Outcome and Need for Hospitalization

Failure of outpatient therapy	Severe bronchospasm
Severity of exacerbation	Concomitant infection or comorbidity
Frequency of exacerbations	Baseline CO2
Inadequate home support or services	Baseline oxygen use
Baseline COPD severity (GOLD Stage)	Older age
Worsening hypoxia or hypercapnia	Low BMI
Encephalopathy	Chronic use of glucocorticoids

Care Process Model

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

MISSION HEALTH

MANAGEMENT OF COPD EXACERBATIONS

ALGORITHM: COPD Exacerbation in the Emergency Room

According to GOLD: Exacerbation of COPD is defined as an acute event characterized by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication.

Patient presents to ED with symptoms suggestive of COPD exacerbation

ASSESS SEVERITY

- Review medical history, including baseline FEV1, frequency of previous exacerbations/hospitalizations, comorbidities, and age
- Measure pulse oximetry (or ABGs if available) to determine need for supplemental oxygen
- Consider performing chest X-ray to identify complications such as pneumonia and/or alternative diagnoses that may mimic symptoms of exacerbation – Consider obtaining EKG to aid in diagnosis of right ventricular hypertrophy, arrhythmias, or ischemia
- Consider other labs: CBC w/Diff, BNP, D-Dimer, Troponin, Sputum culture, Viral Resp. Panel

DETERMINE RISK FOR POOR OUTCOMES AND NEED FOR HOSPITAL ADMISSION

Risk Factors for poor outcomes

- Severe underlying COPD (FEV1 < 50% of predicted)
- Frequent previous exacerbations or hospitalizations (more than 3/year)
- Presence of comorbid conditions
- Antimicrobial use within the last 3 months

Indications for hospital admission

- Older age
- Marked increase in intensity of symptoms, such as sudden development of resting dyspnea
- Use of accessory respiratory muscles
- New onset of central cyanosis or peripheral edema
- Hemodynamic instability
- Signs of right heart failure
- Reduced alertness
- Newly occurring arrhythmias
- Diagnostic uncertainty
- Worsening hypoxia or hypercapnia

Significant risk for poor outcome, possible need for ventilator support, and/or inadequate home support?

yes → **Hospital Admission**
Use COPD Admission PowerPlans
See COPD CPM for more information

no

TREAT Based on SEVERITY of EXACERBATION (independent of stage)

MILD EXACERBATION
No increased sputum volume or purulence
No risk factors for poor outcomes

Treatment: Short-acting beta2-agonists (SABAs) (refer to Medication Table 1)
Increase the dose and/or frequency of inhaled SABAs with or without anticholinergic
Continue previous outpatient inhaler regimen

MODERATE EXACERBATION
Increased sputum volume or purulence
Minimal risk factors for poor outcome

SEVERE EXACERBATION
Increased sputum volume or purulence
Risk factors for poor outcome

Treatment: Short-acting beta2-agonists (SABAs) (refer to Medication Table 1)
Increase the dose and/or frequency of inhaled SABAs with or without anticholinergic and combination
Continue previous outpatient inhaler regimen
Antibiotics (Refer to Medication Table 3) are indicated when sputum volume and/or purulence is increased. Provide coverage for major bacterial pathogens involved in the exacerbation.
Corticosteroids are recommended (refer to Medication Table 2)

Symptoms improving or resolved?

yes → **Discharge**
- Review proper inhaler technique
- Assess patient's access to medication
- Follow-up with PCP 7-14 days

no

Care Process Model

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) © 2017

ALGORITHM: COPD Exacerbation Inpatient Management

Indications for ICU admit

- Severe dyspnea that responds inadequately to initial emergency therapy
- Changes in mental status (confusion, lethargy, coma)
- Persistent or worsening hypoxemia (PaO2 < 5.3 kPa, 40 mmHg) and/or severe/worsening respiratory acidosis (pH < 7.25) despite supplemental oxygen and noninvasive ventilation
- Need for invasive mechanical ventilation
- Hemodynamic instability (need for vasopressors)

Use: Critical Care Admission Plan

Indications for medical admit

- Marked increase in intensity of symptoms, such as sudden development of resting dyspnea
- Severe underlying COPD
- Onset of new physical signs (e.g., cyanosis, peripheral edema)
- Failure of an exacerbation to respond to initial medical management
- Presence of serious comorbidities (e.g., heart failure or newly occurring arrhythmias)
- Frequent exacerbations
- Older age - Insufficient home support

Use: COPD Admission Plan

TREAT Based on SEVERITY of EXACERBATION (independent of stage)

- Short-acting beta2-agonists (SABAs) (refer to Medication Table 1)
- Increase the dose and/or frequency of inhaled SABAs with or without anticholinergic and combination
- Continue previous outpatient inhaler regimen (if appropriate)
- Antibiotics (refer to Medication Table 3) are indicated when sputum volume and/or purulence is increased. Provide coverage for major bacterial pathogens involved in the exacerbation.
- Corticosteroids are recommended (refer to Medication Table 2)

Reevaluate

- Daily evaluation of symptoms consider
- De-escalation of steroids
- De-escalation of antibiotics
- Wean oxygen, early ambulation, PT if required, dietary consult as needed.
- Reevaluate need for CBGs, consider smoking cessation, and palliative care referral for symptom management.

Discharge Recommendations

See COPD Discharge Algorithm

Care Process Model

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) © 2017

MISSION HEALTH

ALGORITHM: Ambulatory COPD Exacerbation

Patient with a diagnosis of COPD presents to outpatient clinic with symptoms of exacerbation, defined in GOLD Guidelines as "an acute worsening of respiratory symptoms that result in additional therapy"

Assess Severity of Exacerbation

- Review medical history (COPD staging, frequency of exacerbations, comorbidities)
- Measure pulse oximetry
- Consider additional studies to evaluate for pneumonia or other diagnosis mimicking symptoms of exacerbation (X-ray, EKG, CBC, d-dimer, sputum culture, viral respiratory panel, etc.)
- Assess risk of poor outcome (older age, severe COPD, frequent exacerbations/hospitalization, presence of comorbid conditions, antimicrobial use in last 3 months)

Mild	Moderate	Severe	Indications for ER and/or Admission
• No increased sputum • No purulent sputum • No risk factors poor outcome	• Increased sputum volume • Sputum purulence • Minimal risk factors for poor outcome	• Increased sputum volume Sputum purulence • Risk for poor outcome • and/or risk for pseudomonas	• Severe symptoms (sudden worsening resting dyspnea, high respiratory rate, decreased oxygen saturation, confusion, drowsiness) • Onset new physical signs • (cyanosis, peripheral edema) • Failure to respond to treatment • Presence of serious comorbidities • Insufficient home support
• Inhaled short-acting beta-2 agonist (SABA) • Consider antibiotics (see side bar) • Consider oral corticosteroids • (see side bar) • Follow up PRN	Consider In-Office: • IM corticosteroids • Nebulized SABA Inhaled SABA Inhaled LABA Antibiotics (see sidebar) Oral corticosteroids (see sidebar) Follow up 24-48 hours	Consider In-Office: • IM corticosteroids • Nebulized SABA Consider Caramedic / Home Health consult Inhaled SABA and LABA Antibiotics (see sidebar) Oral corticosteroids (see sidebar) Follow up 12-24 hours	

Antibiotics:

Indicated when sputum volume and/or purulence is increased First Line

- Amoxicillin-clavulanate (Augmentin) 875 mg-125 mg oral tablet (Rx) - 1 tab, PO (by mouth), BID, X 5 day, treat or prevent infections, # 10 tab
- Doxycycline (Vibramycin hyclate) 100 mg oral capsule (Rx) - 1 cap, PO (by mouth), BID, X 5 day, treat or prevent infections, # 10 cap
- Cefuroxime (Ceftin) 500 mg oral tablet (Rx) - 1 tab, PO (by mouth), BID, X 5 day, treat or prevent infections, # 10 tab

Second Line

- Azithromycin (Zithromax Z-Pak) 250 mg oral tablet (Rx) - 1 packet, PO (by mouth), as directed, X 5 day, treat or prevent infections, as directed on package labeling, # 6 tab
- Levofloxacin (Levaquin) 750 mg oral tablet (Rx) - 1 tab, PO (by mouth), daily, X 5 day, treat or prevent infections, # 5 tab (DEF) (Levaquin black box warning)

If patient has renal impairment (with a CK of 20-49) refer to renal dosing below:

Levofloxacin (Levaquin) 750 mg oral tablet (Rx) - 1 tab, PO (by mouth), every other day, X 5 day, treat or prevent infections, # 3 tab

Oral Corticosteroids:

Recommend short burst with moderate and severe exacerbations, consider longer duration for patients with frequent exacerbations

Glucocorticoids In Office

- Solu-Medrol (AMB) - 62.5 mg, Inj, IM, ONCE
- Glucocorticoids Rx
- predniSONE 20 mg oral tablet (Rx) - 2 tab, PO (by mouth), daily, X 5 day, # 10 tab
- predniSONE 10 mg oral tablet (Rx) - 10 mg, PO (by mouth), daily, instructions:, 4 tablets daily for 3 days then, 3 tablets daily for 3 days then, 2 tablets daily for 3 days, # 27 tab

May consider longer steroid taper for patients with recurrent exacerbations

PHARMACOLOGIC TREATMENT OF EXACERBATIONS

Bronchodilators

Short-acting inhaled beta2-agonists (SABAs) with or without short-acting anticholinergics are usually preferred for treatment of exacerbation. (Evidence C) (See Medication Table I)

Medication Table I. Commonly Used for ED Acute Exacerbation COPD Management (Mission Pharmacy Formulary)

Medication class	Dosage	Frequency	Notes	Cost
Glucocorticosteroids				
methylprednisolone (SoluMEDROL)	62.5 mg inj IV push	1 dose STAT	IV only if severe	$$
methylprednisolone (SoluMEDROL)	125mg inj IV push	1 dose STAT	IV only if severe	$$
Short-acting beta agonist/anticholinergics				
albuterol (Proventil)	2 puff, inhaler, inhale orally	1 dose STAT		$$
albuterol	2.5 mg, 0.5 mL, Inh Soln, nebulized 5 mg, 1 mL, Inh Soln, nebulized 7.5 mg, 1.5 mL, Inh Soln, nebulized	1 dose STAT		$
racemic epinephrine (S2)	0.5 ml, Inh Soln	1 dose STAT		$
albuterol-ipratropium (DuoNeb)	3 mL, Inh Soln, nebulized	1 dose STAT	SABA plus short-acting anticholinergic combination	$

$ = 0-$25
$$ = $26-$50
$$$ = $51-$100
$$$$ = $101-$150
$$$$$ ≥ $150

Corticosteroids

Systemic corticosteroids in acute exacerbation chronic obstructive pulmonary disease (AECOPD) shorten recovery time, improve lung function (FEVI) and arterial hypoxemia (PaO2). (Evidence A)

(See Medication Table 2) Corticosteroids do have significant side effects including hyperglycemia. The optimal duration and route of steroids is uncertain, but duration and dose should be individualized once symptom control is achieved.

Medication Table 2. Steroid Taper

Medication class	Dosage	Frequency	Notes	Cost
Steroid Taper				
Continue current steroid therapy				
Standard 5-Day Taper				
predniSONE (Deltasone)	40 mg PO	Daily	GOLD recommends daily for 5 days, no taper	$
IV to PO Steroid Taper				
methylprednisolone (SoluMEDROL)	62.5 mg inj IV push	Q8H	for 24 hours	$$
methylprednisolone (SoluMEDROL)	40 mg IV	Q8H	for 24 hours	$$
predniSONE (Deltasone)	40 mg PO	Daily	for 5 days	$
12-Day Taper (for frequent exacerbations)				
predniSONE (Deltasone)	10 mg PO		4 tablets daily for 3 days, then 3 tablets daily for 3 days, then 2 tablets daily for 3 days, then 1 tablet daily for 3 days, then stop (30 tab)	$

$ = 0-$25
$$ = $26-$50
$$$ = $51-$100
$$$$ = $101-$150
$$$$$ ≥ $150

Antibiotics

Should be given to patients with three cardinal symptoms; increase dyspnea, increased sputum volume, sputum purulence (Evidence B), OR have two cardinal symptoms if increased purulence of sputum is one of the symptoms (Evidence C), OR require mechanical ventilation (invasive or noninvasive). (Evidence B) (Medication Table 3) Cultures should be obtained to assist antibiotic selection in cases of concomitant pneumonia, frequent exacerbations, or for severe exacerbations warranting ventilator support. An enteral route of therapy is preferred and duration of administration 5-7 days.(4)

Medication Table 3. Antibiotics for COPD Exacerbations

Medication: Antibiotics	Dosage	Notes	Cost
Mild Exacerbation			
amoxicillin-clavulanate (Augmentin)	875 mg PO twice daily x 5 days		$
doxycycline (Vibramycin)	100 mg PO twice daily x 5 days		$
cefuroxime (Ceftin)	500 mg PO twice daily x 5 days		$
azithromycin (Zithromax)	500 mg PO once daily x 3 days		$
Moderate to Severe Exacerbation			
amoxicillin-clavulanate (Augmentin)	875 mg PO twice daily x 5 days		$
levofloxacin (Levaquin)	750 mg PO once daily x 5 days		$
levofloxacin (Levaquin)	750 mg IVPB Q24H	IV only if unable to take PO	$
ceftriaxone (Rocephin)	1g IVPB Q24H	IV only if unable to take PO	$
ampicillin-sulbactam (Unasyn)	3g IVPB Q6H	IV only if unable to take PO ampicillin content = 2 g	$$
Moderate to Severe Exacerbation with Risk Factors for Pseudomonas			
cefepime (Maxipime)	1g IVPB Q8H	Infuse over 4 hours	$$
ciprofloxacin (Cipro)	750 mg PO twice daily x 7 days		
piperacillin-tazobactam (Zosyn)	3.375 g IVPB Q8H	Infuse over four hours. Combination therapy of two therapeutically different agents empirically may be desired in some cases. Switching to oral route is recommended when clinical stabilization permits.	$$$

$ = 0-$25
$$ = $26-$50
$$$ = $51-$100
$$$$ = $101-$150
$$$$$ ≥ $150

ADJUNCTIVE THERAPIES

Noninvasive Mechanical Ventilation

Noninvasive ventilation (NIV) is a major treatment modality for acute exacerbations of COPD.(I9) It avoids intubation in most patients and provides effective relief of respiratory muscle work during an exacerbation, allowing initiation of concomitant therapy to reverse respiratory failure.

Use of noninvasive mechanical ventilation should be considered with the any of the following:

- Acute respiratory acidosis (arterial less than pH 7.35 and/or $PaCO_2 \geq 6.0$ kPa/45 mm Hg)(4)
- Severe dyspnea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing, or both, such as use of respiratory accessory muscles, paradoxical motion of the abdomen, or retraction of the intercostal spaces(4)

Proper mask fitting and careful coaching by a trained respiratory therapist is key to success. In addition, selection and placement of patients into appropriate stepdown units or ICU settings allows for safe and effective use of NIV. Use of NIV is associated with higher risk of mortality at the time of hospitalization and also increases future mortality risk.(20)

Complications of NIV use include skin abrasion and breakdown, anxiety related to claustrophobia, aerophagia, and gastric distention.

Palliative Care

Patients with COPD often have several other comorbidities that may have a significant impact on prognosis. Palliative care should be available to patients at all stages of illness and should be individualized based on the needs and preferences of the patient and the patient's family. An interdisciplinary approach to providing palliative care is an effective way to meet all the needs of the patient, family, other loved ones, and caregivers.(4,2I) The multidisciplinary team should address palliative care needs during daily rounds.

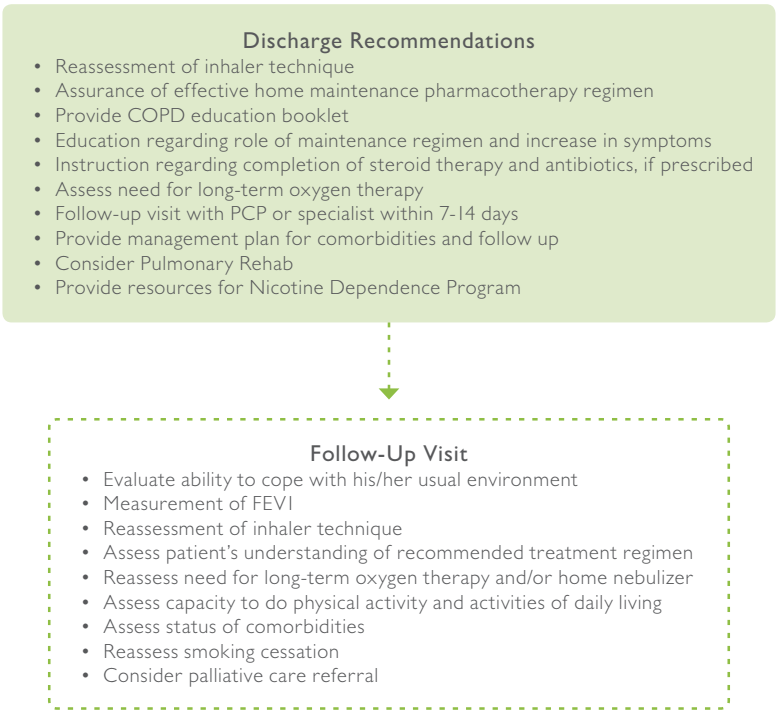
- Assess other disease processes along with severity of lung function impairment, frequency of exacerbations, requirement for long term oxygen therapy, symptom burden and impact on activities of daily living for patients with COPD(2I)
- Assess and identify when to provide palliative care that may include end of life care(22)
- Consult with palliative care specialists as appropriate for managing palliative care situations beyond the clinician's level of competence(2I)
- Consider the need for outpatient palliative care consult to provide support and symptom management during the last weeks of life(23)

DISCHARGE

When to Consider Discharge

- Able to use long-acting bronchodilators, either beta2-agonists and/or anticholinergics with or without inhaled corticosteroids
- Inhaled short-acting beta2-agonist therapy is required no more frequently than every 4 hours
- Patient, if previously ambulatory, can walk across room
- Patient can eat and sleep without frequent awakening by dyspnea
- Patient has been clinically stable for 12-24 hours
- Arterial blood gases have been stable for 12-24 hours
- Patient (or home caregiver) fully understands correct use of medications and has access to them
- Follow-up and home-care arrangements have been completed (e.g., visiting nurse, palliative care, hospice, oxygen delivery, meal provisions)
- Patient, family, and physician are confident that the patient can manage successfully at home

Algorithm: COPD Discharge



Timing of Follow-Up

Appropriate and timely follow up of the patient after a COPD exacerbation is a key to preventing readmission and re-exacerbation. Optimal timing is within 30 days of discharge. Follow up can be with the patient's primary care provider or their pulmonologist.(24)

Medicine Optimization at Discharge

While inpatient management often focuses on acute management – with the addition of steroids and antibiotics as pharmacotherapy – it is imperative to review optimal medicines and tailor these to the specific patient for continued chronic disease management. Appropriate selection of ongoing medicines at discharge may be influenced by cost, access, and ease of use. The addition of appropriate long-acting medicines based on COPD stage can prevent readmission (Table I.3). Furthermore, starting these medicines before discharge allows adequate teaching and discovery of other barriers that prevent use.

Impacts of Exacerbation

Exacerbations are a significant event for a patient with COPD and each event causes a worsening of symptoms and a higher likelihood of death.(25) (Table I.6)

Table I.6 Exacerbations, Hospitalizations, and Mortality Risk by GOLD Severity

Risk in COPD: Placebo-limb Data from TORCH*[26], Uplift†[27, 28], and Eclipse≠ [29]			
GOLD Class Severity	Exacerbations (per year)*†≠	Hospitalizations (per year)* ≠	3-year Mortality*†
GOLD 1: Mild	?	?	?
GOLD 2: Moderate	0.7-0.9	0.11-0.2	11%*†
GOLD 3: Severe	1.1-1.3	0.25-0.3	15%*
GOLD 4: Very Severe	1.2-2.0	0.4-0.54	24%*

Preventing Recurrent Exacerbations

Outpatient COPD interventions aim to reduce symptoms and improve quality of life, but also strive to reduce exacerbations. As discussed, we can impact exacerbation reduction by utilizing best practice recommendations across the continuum of care.

Hospitals carry a large burden of responsibility in reducing recurrent exacerbations due to complexities of reimbursement tied to Medicare and readmission rates. The Medicare Hospital Readmissions Reduction Program (HRRP) included COPD in 2014. This program penalizes hospitals up to 3 percent for recurrent 30-day readmissions of COPD patients. In response, hospitals are focusing resources on prevention. With 1 in 5 patients requiring rehospitalization (20 percent or more) and estimates that 10-55 percent of COPD exacerbations are preventable(31), there is much work to be done.

Identifying risk factors (Table 1.7) and addressing them at the time of index hospitalization is difficult, and models of prediction are lacking. Current recommended interventions to prevent readmission are being developed but require further study and validation. (Table 1.8)

Table 1.7 Risk Factors for Early Readmission after COPD Exacerbation

Male gender	African American race
Low BMI	CHF or other chronic medical conditions (68% have at least one comorbidity)
Longer length of stay	Psychiatric diagnosis (including depression)
Elevated CO2	Frailty
Dual eligibility for Medicare and Medicaid	

Table 1.8 Interventions to Prevent Readmissions(30)

Known Effective	Proposed
Inhaler device training	Telehealth
Patient self-management (action plans, coping mechanisms, smoking cessation)	At discharge medicine dispensing
Early follow-up within 30 days	Pharmacist medication reconciliation
Pulmonary rehabilitation	Appropriate medicines
	Hospital at home

AMBULATORY CONSIDERATIONS

COPD is a disease that is familiar in the primary care setting and requires early diagnosis and thoughtful management. Early diagnosis and treatment delays disease progression and enables avoidance of exacerbations, which greatly impacts the overall quality of life for patients with COPD. It is critical for healthcare providers to deliver patient-centered care to promote long-term success of patients living with COPD. Below are special considerations for the ambulatory environment:

Spirometry

If appropriate, providers should consider pulmonary function testing in patients who have COPD and are in a stable state (i.e., not in an exacerbation) yearly. Pre-/post-bronchodilator spirometry should be performed, with the classification of COPD severity based on post-bronchodilator values. (See Figure I for sample flow volume loops on page 6.)

Pharmacological Management

Evaluation and management of a patient's current medication regimen must be ongoing and is especially important following hospitalization. The GOLD guidelines provide guidance for medication management based on symptoms and COPD severity; however, they also recognize the need to incorporate a personalized approach with escalation and de-escalation of medication.(4) GOLD Grade assessment allows both symptoms (number of exacerbations or hospitalizations, as well as subjective assessment) and FEVI to be factored into the appropriate medication selections. (Table I.3)

Pulmonary Rehabilitation

Referral for pulmonary rehabilitation is appropriate for most patients and has been shown to especially benefit patients with advanced disease.(4)

Prognostication

Outpatient assessment of prognosis is aided by use of the **BODE** index. The index includes assessment of **BMI** (body mass index), **O**bstruction (FEVI), **D**yspnea (evaluated by MRC dyspnea score), and **E**xercise capacity (6-minute walk testing).(4)

Pulmonary Referral

Appropriate referral to a pulmonologist may aid in optimization and care for advancing disease and/or symptom management.

Team-Based Care

A multidisciplinary care team is a critical component in a high-performing primary care clinic and incorporates:

- Clinical Pharmacists assist with vaccination surveillance, teaching inhaler technique, improving medication adherence, and accessing medications through medication assistance programs.
- Behavioral Health professionals assist with smoking cessation and cognitive behavioral therapy to reduce anxiety and depression often associated with chronic disease.
- Care Managers assist with transitions of care and can further assist patients who recognize worsening symptoms.
- Specially trained Respiratory Therapists and Nurses have an important role in obtaining reproducible and

acceptable spirometry readings to adequately stage patients.

Transitions of Care

A clinic philosophy that ensures early follow up from emergency room and hospital visits is critical to avoiding unnecessary health care costs and adverse outcomes.

To further improve care and avoid hospitalizations, consider:

- Easy access to appointments when having increased COPD symptoms
- Utilizing Caramedics to follow up on patients in their home environment
- Providing Home Health for patients with additional needs
- Utilizing Pulmonary Rehabilitation
- Continued partnerships with specialists in disease management

Advanced Care Planning

The rate of disease progression will vary among the COPD population. Overall health, comorbidities, smoking, and continued exposure to environmental factors can further impact the rate of progression. Therefore, end-of-life care should be discussed early in the course of the disease. Healthcare providers in the ambulatory setting are instrumental in starting these discussions with their patients. Providers should inform patients of available palliative care services and make referrals as needed or requested.

METRICS

Metrics serve as important elements in the creation of the templates in the electronic medical record and will be collected and reported as they become available in our information systems. The following metrics will be used by Mission Health as a measure of the quality care we provide. These measures are based on national standards of care and signal critical points in the care of patients with COPD.

Inpatient

- Average Length of Stay: Calculated by dividing the sum of inpatient days by the number of patient admissions with a primary diagnosis of COPD
- Readmission Rate: All cause readmissions within 30 days of discharge in patients discharged with a principal diagnosis of COPD
- Average Cost per Case: Calculated by dividing the sum of costs for patients with a primary diagnosis of COPD by the total number of patient admissions
- COPD Staging: Percentage of patients 18+ years with a principal discharge diagnosis of COPD who had a documented GOLD COPD classification
- COPD PowerPlans Utilization: Percentage of patients aged 18+ years with a principal discharge diagnosis of COPD who had the COPD PowerPlan or COPD SubPlan activated during hospitalization

- Smoking Cessation: Percentage of appropriate referrals who had their referral completed

Transition

- Post-Discharge Follow-Up Appointment: Post-discharge follow-up appointment within 14 days of discharge ordered
- Post-Discharge Follow-up Kept: Percentage of patients 18+ years with a principal discharge diagnosis of COPD who kept their follow-up appointment within 14 days of discharge
- Pulmonary Navigator Calls: Percentage of high-risk Medicare patients with a principal discharge diagnosis of COPD who receive telephone follow-up care

Outpatient

- COPD Exacerbation PowerPlans Utilization: Percentage of patients aged 18+ years with a diagnosis of COPD exacerbation who had the COPD exacerbation PowerPlan used
- COPD Staging: Percentage of patients aged 18+ years with a diagnosis of COPD who had spirometry or PFT performed in the prior 12 months
- Smoking Cessation: Percentage of patients aged 18+ years with a diagnosis of COPD who use tobacco and had smoking cessation counseling in the prior 12 months
- Influenza Immunizations: Percentage of patients aged 18+ years with a diagnosis of COPD who had influenza vaccine in prior 12 months
- Pneumonia Immunization: Percentage of patients aged 18+ years with a diagnosis of COPD who had pneumococcal vaccine

RESOURCES

Mission Guides

"COPD Zones" magnet outlining daily instructions and when to call the physician office

"Living with Chronic Obstructive Pulmonary Disease (COPD)" Mission Health patient guide. This booklet provides a general overview of COPD and key self-care requirements

"Your Passport to Better Health" COPD pamphlet

Online

COPD Foundation
https://www.copdfoundation.org/Screener.aspx?gclid=COmGudKputECFYc9gQodU9gLWA

Global Initiative for Chronic Obstructive Lung Disease (GOLD)
http://goldcopd.org/

National Committee for Quality Assurance
http://www.ncqa.org/

NCDHHS Tobacco Prevention and Control
http://www.tobaccopreventionandcontrol.ncdhhs.gov/

QuitlineNC
http://www.quitlinenc.com/

Tobacco Control Research Branch of the National Cancer Institute
https://smokefree.gov/

Center to Advance Palliative Care
https://getpalliativecare.org/

REFERENCES

1. Brown, K.E., et al., Order Set to Improve the Care of Patients Hospitalized for an Exacerbation of Chronic Obstructive Pulmonary Disease. Annals of the American Thoracic Society, 2016. 13(6): p. 811-815.
2. Patel, J.G., S.P. Nagar, and A.A. Dalal, Indirect Costs in Chronic Obstructive Pulmonary Disease: A Review of the Economic Burden on Employers and Individuals in the United States. Int J Chron Obstruct Pulmon Dis, 2014. 9: p. 289-300.
3. Chronic Obstructive Pulmonary Disease. Fact Sheet. World Health Organization, WHO Media Centre, 2015(March).
4. Global Strategy for the Diagnosis, Managment, and Prevention of Chronic Obstructive Pulmonary Disease. Global Initiative for Chronic Obstructive Lung Disease, 2017.
5. Evans, J., et al., Estimating the Prevalence of COPD in Canada: Reported Diagnosis versus Measured Airflow Obstruction. Health Rep, 2014. 25(3): p. 3-11.
6. Boulet, L.P., et al., Major Care Gaps in Asthma, Sleep and Chronic Obstructive Pulmonary Disease: A Road Map for Knowledge Translation. Can Respir J, 2013. 20(4): p. 265-9.
7. Kitchlu, A., et al., Gaps in the Inpatient Management of Chronic Obstructive Pulmonary Disease Exacerbation and Impact of an Evidence-Based Order Set. Can Respir J, 2015. 22(3): p. 157-62.
8. Sandhaus, R.A., et al., The Diagnosis and Management of Alpha-1 Antitrypsin Deficiency in the Adult. Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation. 3(3): p. 668-682.
9. Celli, B.R., et al., The Body-Mass Index, Airflow Obstruction, Dyspnea, and Exercise Capacity Index in Chronic Obstructive Pulmonary Disease. N Engl J Med, 2004. 350(10): p. 1005-12.
10. Long-Term Oxygen Treatment Trial Research, G., A Randomized Trial of Long-Term Oxygen for COPD with Moderate Desaturation. N Engl J Med, 2016. 375(17): p. 1617-1627.
11. de Molina, R. M., Mortensen, E., Restrepo, M., Copeland, L., Pugh, M., & Anzueto, A. (2010). Inhaled Corticosteroid Use Is Associated with Lower Mortality for Subjects with COPD and Hospitalised with Pneumonia. European Respiratory Journal, 36(4), 751-757.
12. Miravitlles, M., et al., Pharmacological Strategies to Reduce Exacerbation Risk in COPD: A Narrative Review. Respiratory research, 2016. 17(1): p. 112.
13. Albert, R.K., et al., Azithromycin for Prevention of Exacerbations of COPD. N Engl J Med, 2011. 365(8): p. 689-98.
14. Ries, A.L., et al., Pulmonary Rehabilitation: Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. Chest, 2007. 131(5 Suppl): p. 4S-42S.
15. Rodriguez-Roisin, R., Toward a Consensus Definition for COPD Exacerbations. Chest, 2000. 117(5 Suppl 2): p. 398S-401S.
16. Burge, S. and J.A. Wedzicha, COPD Exacerbations: Definitions and Classifications. Eur Respir J Suppl, 2003. 41: p. 46s-53s.
17. Celli, B.R. and P.J. Barnes, Exacerbations of Chronic Obstructive Pulmonary Disease. Eur Respir J, 2007. 29(6): p. 1224-38.
18. Donaldson, G.C., et al., Impact of Prolonged Exacerbation Recovery in Chronic Obstructive Pulmonary Disease. American Journal of Respiratory and Critical Care Medicine, 2015. 192(8): p. 943-950.
19. Garpestad, E., J. Brennan, and N.S. Hill, Noninvasive Ventilation for Critical Care. Chest, 2007. 132(2): p. 711-720.
20. Ankjærgaard, K.L., et al., COPD: Mortality and Readmissions in Relation to Number of Admissions with Noninvasive Ventilation. COPD, 2016: p. 1-7.
21. Lanken, P.N., et al., An official American Thoracic Society Clinical Policy Statement: Palliative Care for Patients with Respiratory Diseases and Critical Illnesses. American Journal of Respiratory and Critical Care Medicine, 2008. 177(8): p. 912-927.
22. Iley, K., Improving Palliative Care for Ppatients with COPD. Nurs Stand, 2012. 26(37): p. 40-6.
23. Seow, H., et al., Impact of Community-Based, Specialist Palliative Care Teams on Hospitalisations and Emergency Department Visits Late in Life and Hospital Deaths: A Pooled Analysis. BMJ, 2014. 348: p. g3496.
24. Sharma, G., et al., Outpatient Follow-Up Visit and 30-Day Emergency Department Visit and Readmission in Patients Hospitalized for Chronic Obstructive Pulmonary Disease. Archives of Internal Medicine, 2010. 170(18): p. 1664-1670.
25. Akhter, S., et al., A Comparison of Three Severity Assessment Scores: APACHI II SOFA and CURB 65 for Predicting Inpatient Mortality in Patients with Acute Exacerbation of COPD (AECOPD). European Respiratory Journal, 2015. 46(suppl 59): p. PA2169.
26. Suissa, S., S. Dell'Aniello, and P. Ernst, Long-Term Natural History of Chronic Obstructive Pulmonary Disease: Severe Exacerbations and Mortality. Thorax, 2012. 67(11): p. 957-963.
27. Group, T.S., The TORCH (Towards a Revolution in COPD Health) Survival Study Protocol. European Respiratory Journal, 2004. 24(2): p. 206-210.
28. Troosters, T., et al., Tiotropium as a First Maintenance Drug in COPD: Secondary Analysis of the UPLIFT® Trial. European Respiratory Journal, 2010. 36(1): p. 65-73.
29. Vestbo, J. and T.S. Group, The TORCH (Towards a Revolution in COPD Health) Survival Study Protocol. Eur Respir J, 2004. 24(2): p. 206-10.
30. Agusti, A., et al., Characterisation of COPD Heterogeneity in the ECLIPSE Cohort. Respiratory Research, 2010. 11(1): p. 1.
31. Auerbach, A.D., et al., Preventability and Causes of Readmissions in a National Cohort of General Medicine Patients. JAMA Internal Medicine, 2016. 176(4): p. 484-493.

NOTES

These guidelines apply to common clinical situations and may not be appropriate for certain patients or circumstances. This Care Process Model does not replace provider judgment. The provider will decide which patients will participate in the CPM and which elements of the plan are based on individual patient assessment.

ACHIEVING THE BIG(GER) AIM

Mission Health strives to provide world-class care to patients and their families when they need it most. Our BIG(GER) Aim is to get every person to their desired outcome, first without harm, also without waste and always with an exceptional experience for each person, family and team member.

ABOUT MISSION HEALTH

Mission Health, based in Asheville, North Carolina, is the state's sixth-largest health system and was recognized as one of the nation's Top 15 Health Systems from 2012-2015 by Truven Health Analytics, formerly Thomson Reuters, becoming the only health system in North Carolina to achieve this recognition. Mission Health operates six hospitals, numerous outpatient and surgery centers, post-acute care provider CarePartners, long-term acute care provider Asheville Specialty Hospital, and the region's only dedicated Level II trauma center. With approximately 12,000 team members and 2,000 volunteers, Mission Health is dedicated to improving the health and wellness of the people of western North Carolina. For more information, please visit mission-health.org or @MissionHealthNC.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